The role of defects in fluorescent silicon carbide layers grown by sublimation epitaxy

Schimmel, Saskia; Kaiser, Michl; Jokubavicius, Valdas; Ou, Yiyu; Hens, Philip; Linnarsson, Margareta; Sun, Jianwu; Liljedahl, Rickard; Ou, Haiyan; Syväjärvi, Mikael

Total number of authors:
11

Publication date:
2013

The role of defects in fluorescent silicon carbide layers grown by sublimation epitaxy

Saskia Schimmel, Michl Kaiser, Valdas Jokubavicius, Yiyu Ou, Philip Hens, Margareta Linnarsson, Jianwu Sun, Rickard Liljedahl, Haiyan Ou , Mikael Syväjärvi, Peter Wellmann

Donor-acceptor co-doped silicon carbide layers are promising light converters for novel monolithic all-semiconductor LEDs due to their broad-band donor-acceptor pair luminescence and potentially high internal quantum efficiency. Besides appropriate doping concentrations yielding low radiative lifetimes, high nonradiative lifetimes are crucial for efficient light conversion.

Despite the excellent crystalline quality that can generally be obtained by sublimation epitaxy according to XRD measurements, the role of defects in f-SiC is not yet well understood.

Recent results from room temperature photoluminescence, charge carrier lifetime measurements by microwave detected photoconductivity and internal quantum efficiency measurements suggest that the internal quantum efficiency of f-SiC layers is significantly affected by the incorporation of defects during epitaxy. Defect formation seems to be related to nitrogen incorporation from the growth ambient while nitrogen doping from the source yielded better results regarding quantum efficiency. To investigate the presence of different types of defects in f-SiC layers and their impact on the fluorescent properties of f-SiC, this study will focus on defect characterization of f-SiC layers grown under different process conditions, especially different growth ambient and using differently doped source material. The results may help to identify critical process parameters and reduce the concentration of relevant defects.